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A device and a method for sampling of milk

10 **THE BACKGROUND OF THE INVENTION AND PRIOR ART**

The present invention relates to a device and a method for sampling of milk from an animal the milk of which is to be tested, wherein the device comprises a collecting member
15 arranged to receive milk samples from a milk line, which is arranged to transport milk from one animal at a time, and a passage arranged to allow a milk flow from a milk line to the collecting member.

20 Sampling of milk is performed in order to analyse the quality of the milk. Thereby, the content of particular substances and the existent of bacterium in the milk of individual cows may be analysed. Usually, tubes having a relative small inner diameter are used for delivering milk samples from a milk line to a milk
25 analysing device. Inevitably, milk residues from previous samplings are stored as a thin film along the inner walls of such tubes. Usually, these tubes have a relative small inner diameter. Thereby, the amount of milk forming this film is not negligible in relation to the whole amount of milk in a sample. Consequently,
30 the risk is obvious that milk samples conveyed by such tubes comprises a relatively high percentage of milk from previously milked cows. Thereby, the result of the analysis of a milk sample from a specific cow may be influenced of milk from previously milked cows.

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- WO 92/15196 shows an apparatus for sampling of milk from a milk line. The apparatus comprises a by-pass line comprising a pump, a timer, a sampling valve and a test actuator. A milk flow is obtained in the by-pass line during a test period when the timer is set in a position, which initiates activation of the pump. Thus, a milk flow through the by-pass is here obtained during the sampling time period. There is a big risk that milk residues from a previous milked cow in the by-pass line are mixed with the milk sample of the cow, which is to be tested. In an embodiment of this invention, the milk is streamed to the by-pass via an inlet opening in a collector inside the milk line. After the milk has passed through the by-pass line, it is guided back to the milk line, via an outlet opening, to the collector. The outlet opening in the collector is positioned at a small distance downstream of the inlet opening. Especially at a low milk flow in the milk line, it is an obvious risk that milk from different cows is mixed in the collector and milk from previously milked cows is guided back into the inlet opening of the by-pass line.
- DE 23 54 820 shows a milk line having an extension between a first container and a second container. A conduit has an extension between these containers in parallel with the ordinary milk line. A sampling device is arranged to allow sampling of the milk in the conduit. The sampling device, which has a relatively complex construction, is arranged to discharge milking samples from the conduit, via a branch conduit, to a sample container.

SUMMARY OF THE INVENTION

- The object of the present invention is to provide a sampling device and a method, which provide reliable milk samples from individual animals without influences of possible milk residues stored in the conduit arrangement from previously milked animals.

This object is achieved in that the device comprises flow means arranged to provide a flow of milk from said animal through at least a part of the passage at least a time period before a milk sample is collected in the collecting member in order to rinse at least said part of the passage. Such a milk flow in the passage removes relatively quickly possible residues of milk from a previously milked animal in the conduit. Thereby, the risk that such milk residues will affect a milk sample of the milk from the milked animal is substantially eliminated. Such a rinsing process of the passage is very simple and it does not require a disconnection of the conduit arrangement from the milk line. The rinsing process does not remain any residue of water or another cleaning liquid into the conduit, which may affect the milk sample. Consequently, a drying process in order to remove such water or a cleaning liquid from the passage is also unnecessary. The rinsing process does not affect the milking process at all.

According to a preferred embodiment of the invention, the conduit arrangement comprises a conduit loop, having a first end connected to a milk line and a second end connected to the milk line at a distance from the first end, and a valve member arranged to allow a discharge of the milk in the conduit loop to the collecting member, wherein a first part of the conduit loop, which has an extension from the first end to the valve member, comprises a first part of said passage. The second end, which comprises an outlet opening, is thus connected to the milk line at a distance downstream of the first end, which comprises the inlet opening. Thereby, the milk, which has passed through the conduit loop, is prevented to return into the inlet opening. The milk flow through the conduit loop may rinse said first part of the conduit. Said milk is then guided back to the milk line. Thus, the milk, used to rinse the first part of the passage, does not need any special collecting containers and it does not be discarded. Consequently, The rinsing process achieved by the milk from the animal, which is milked, is simple, quick and effective.

Advantageously, the conduit arrangement comprises a second conduit, having an extension from the valve member to the collecting member, which second conduit comprises a second part of the passage. In most cases, at least a short such a second conduit is necessary to arrange in order to transport the milk from the conduit loop to the collecting member. However, this second part of the passage is preferably much shorter than the first part of the passage. Advantageously, a milk flow from said animal is also arranged to flow through the second part of the passage in order to rinse it from milk residues from previously milked animals. Thereby, the whole passage is rinsed by milk from the animal to be milked and the affect of a milk sample from previously milked animals is substantially eliminated.

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According to a preferred embodiment of the invention, the flow means is arranged to provide said milk flow in at least said part of the passage, which is arranged to allow a transportation of a milk flow from the milk line to the collecting member, as soon as milk from said animal flows in the milk line at the first end of the conduit loop. Thereby, the rinsing process starts as soon as it is possible to use milk from the milked animal to rinse the passage. After, for example, a determined time period or after that a determined amount of the milk has passed through the valve member, a sample of the milk may be taken. However, said flow may be achieved in other ways. Advantageously, the flow means comprises a pump in the first part of the passage. By using such a pump, a milk flow in the conduit loop is guaranteed, which provides the rinsing process of the first part of the passage. Alternatively, the flow means may comprise gravitation and the pressure difference, between the ends of the conduit loop for providing a milk flow in the conduit loop.

35 According to another preferred embodiment of the invention, the conduit has a smaller inner cross-section area than the milk line.

The conduit may, for example, have a diameter of about 2mm. Thereby, only a relatively small amount of the milk in the milk line needs to be sucked into the conduit. Preferably, the valve member comprises a three-way valve. A three-way valve may be positioned in a first position, in which it allows a milk flow through the whole conduit loop. The three-way valve may be switched to a second position, in which it discharges the milk from the conduit loop to the second conduit. After a time period when the initial milk flow has rinsed the passage through the second conduit, a milk sample is collected in the collecting member of the final part of the milk flow. The collecting member may be a test tube or a container. The milk, which has rinsed the second conduit, may be collected in a separate container or guided back to the conduit loop downstream of the three-way valve.

The collecting member may be comprised in an analysing device. The analysing device is arranged to analyse the quality of the milk in the sample. Thereby, the content of particular substances and the existent of bacterium in the milk sample may be analysed. The flow means may comprise a pump arranged in the analysing device. Thereby, when the three-way valve allows a milk flow through the second conduit, the pump sucks the milk from the milk line into the passage to the collecting member. Thereby, the flow of the milk sample from the milk line to the analysing device is guaranteed.

According to another preferred embodiment of the invention, the device may comprise a control unit, which is arranged to be connected to the valve member and arranged to initiate said discharge of the milk from the conduit loop. Such a control unit may be a computer device, which initiates a substantially arbitrary sampling of the milk from the animal to be milked. The control unit may be able to switch, for example, the three-way valve to the first position, in which a milk flow is guided through the whole conduit loop, and to a second position, in which a milk

flow is guided from the first end of the conduit loop to the collecting member in the analysing device. The control unit may set the three-way valve in the second position during a time period such that a suitable amount of milk from the conduit loop is guided to the second conduit. The initial part of the milk flow in the second conduit is used to rinse the passage and the final part of the milk flow is collected in the collecting member as a milk sample. The control unit may be arranged to initiate sampling of the milk from the conduit only after that an amount of milk from said animal has passed through the valve member. Such an amount is the estimated amount for rinsing the first part of the passage from milk residues from a previously milked animal. Advantageously, the control unit is connected to an identity sensor and arranged to receive information from the sensor about the identity of the animal. In an automatic sampling device such an information is necessary in order to relate a milk sample to a specific animal.

According to another preferred embodiment of the invention, the control unit is connected to a flow meter and arranged to receive information from the flow meter about the presence of a milk flow in the milk line. With such information, the control unit may control the activation of the pump in the first part of the passage. Thereby, the pump may be started, as soon as a milk flow is presence in the milk line and stopped as soon as the milk flow has ended in the milk line. Alternatively, the pump may be driven substantially continuously. The control unit may be connected to the analysing device and be arranged to receive information from the analysing device about the results of the milk samples. Thereby, the control unit may store the result of the analysed milk sample. The control unit may also have the possibility to control a removing unit, which removes the milk from a specific animal if the milk sample discloses that the quality of the milk is not sufficiently high. The milk from a specific animal may be stored in a primary container until the

control unit receives information about the quality of the milk from the analysing device.

5 According to another preferred embodiment of the invention, the device is connected to a milk line arranged to transport milk from one teat of an animal at a time. Thereby, an infected teat of an animal may be detected and the milk from such a teat discarded.

10 The invention relates also to a method for sampling of milk from an animal the milk of which is to be tested, wherein a device is used comprising a collecting member arranged to receive milk samples from a milk line, which is arranged to transport milk from one animal at a time, and a passage arranged to allow a
15 flow of milk from the milk line to the collecting member. The method is characterised by the step of: providing a milk flow from said animal through at least a part of the passage at least a time period before a milk sample is taken in order to rinse at least said part of the passage from milk residues from a
20 previously milked animal. The initial milk flow from said animal removes effectively possible residues of milk from previously milked animals in the passage. Thereby, the risk that a milk sample is mixed with milk from previously milked animals is substantially eliminated. Consequently, an effective rinsing
25 process of the passage from milk residuals is obtained in a quick and simple way.

BRIEF DESCRIPTION OF THE DRAWINGS

30 The present invention is now to be explained more closely by means of a preferred embodiment, which is disclosed as an example, and with reference to the attached drawings.

35 Fig. 1 shows a milk line with a device for sampling of milk according to the invention,

Fig. 2 shows a first embodiment of a device for sampling of milk and

Fig. 3 shows a second embodiment of a device for sampling of milk.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

10 Fig 1 shows a milk line 1 having an extension from a claw 2, which is attachable to a cow 3 during a milking process. The milk line 1 is arranged to convey milk from the cow 3 to a collecting container 4. A vacuum pump 5 guarantees the transport of the milk to the collecting container 4. A sampling device 6 is connected to the milk line 1, for allowing sampling of
15 the milk from the milk line 1. Since the milk line 1 has an extension from only one claw 2, the milk in the milk line 1 originates from one cow 3 at a time. In order to identify the milked cow 3, a reading device 7 is arranged to read a specific code from a transponder, which, in this case, is attached to an
20 ear of the cow 3. The sampling device 6 is arranged to discharge a small amount of the milk flowing in the milk line 1 as a milk sample. Thereafter, the content of particular substances and bacterium in the milk sample is analysed.

25 Fig. 2 shows a first embodiment of a sampling device 6 according to the present invention. The sampling device 6 comprises a conduit loop 8 having an inlet opening at a first end 9, which is connected to the milk line 1, and an outlet opening at a second end 10. Thereby, a part of the milk, which flows in the
30 milk line 1, allows to flow into the inlet opening at the first end 9 of the conduit loop 8. The milk in the conduit loop 8 is guided back to the milk line 1, via the outlet opening in the second end 10. Since the second end 10 is connected to the milk line 1 at a distance downstream of the first end 9, the milk, which has
35 passed through the conduit loop 8, is prevented to return to the conduit loop 8. The conduit loop has a substantially smaller

inner cross-section area than the milk line 1. Thereby, only a relatively small amount of the milk flow in the milk line 1 is sucked into the conduit loop 8.

5 A pump 11 and a three-way valve 12 are arranged in the conduit loop 8. The pump 11 is positioned in a first part 8a of the conduit loop 8, which first part 8a has an extension from the first end 9 to the three-way valve 12. The three-way valve 12 is mostly positioned in a first position, in which it allows the milk to
10 pass through the valve 12 in a direction towards the outlet opening 10. When a milk sample is desired, the three-way valve 12 is switched to a second position. In this second position the three-way valve 12 discharges the milk flow from the first part of conduit loop 8a to a second conduit 13, which guides the milk to
15 a milk analysing device 14. The analysing device 14 comprises a collecting member 15 arranged to collect milk samples. Consequently, the milk is transported through a passage, which extends from the milk line 1 to the collecting member 15. The passage comprises a first part having an extension through the
20 first part 8a of the conduit loop 8 and a second part having an extension through the second conduit 13. A flow meter 16 is arranged in the milk line 1 in order to measure the flow rate in the milk line 1. Furthermore, the sampling device 6 comprises a control unit 17, which is arranged to supervise and control the
25 milk sampling process. Such a control unit 17 comprises a computer unit. By using such a control unit 17, a substantially automatic sampling of the milk from individual cows 3 is possible to accomplish.

30 When a cow 3 has entered, for example, a milking stall, the claw 2 is attached to the cow 3. The reading device 7 reads the identity of the cow 3 and informs the control unit 17 about the identity of the cow 3 by a signal. The milking process is started and the milk from the cow 3 begins to flow in the milk line 1. The
35 milk in the milk line 1 is transported by the vacuum pump 5 in a direction towards the collecting container 4. The flow meter 16

detects the milk flow in the milk line 1. The control unit 17 is informed by a signal from the flow meter 16. The control unit 17 initiates activation of the pump 11, which establishes a negative pressure at the first end 9 of the conduit loop 8. Thereby, a part of the milk, flowing in the milk line 1, is sucked into the conduit loop 8, via the inlet opening, at the first end 9.

The milk flow, from the cow 3, removes possible milk residues in the conduit loop 8 from the previously milked cow. Such milk residues are stored as a thin film along the inner wall surface of the conduit loop 8. Consequently, by using the milk from the cow, which is milked, to rinse the conduit loop 8, a very simple, quick and effective rinsing of the conduit loop 8 from milk residues is achieved. Thereby, remaining milk residues in the first part 8a of the conduit loop 8 will not influence on a milk sample of the presently milked cow 3. The control unit 17 initiates sampling of the cow 3 only after that a time period has passed and/or a suitable amount of milk from the cow 3 has flown through the three-way valve 12 in the conduit loop 8. When, such a suitable amount of milk has flown through the three-way valve 12, the risk is substantially eliminated that milk residues from the previously milked cow is remaining in the first part 8a of the conduit loop 8.

When a sample of the milk from the cow 3 has to be taken, the control unit 17 initiates an adjustment of the three-way valve 12 from the first position to the second position. The milk in the first part 8a of the conduit loop 8 is now pressed into the second conduit 13 by the pump 11. The initial milk flow in the second conduit 13 is transported through the analysing device and out through an outlet conduit 18. The outlet conduit 18 may transport this milk back to the conduit loop 8 downstream of the three-way valve 12 or to a specific collecting container. Thereby, the initial milk flow through the second conduit 13 removes milk residues from a previously tested cow. The final milk flow in the second conduit 13 is guided to the collecting member 15. Such a

guiding of the milk to the outlet conduit 18 or the collecting member 15 may, for example, be performed by a suitable valve member.

5 By information about the flow rate in the milk line 1, the control unit 17 may keep the three-way valve 12 in the second position at a time period such that a desired amount of milk for rinsing and for sampling is delivered through the second conduit 13. The three-way valve 12 is then switched back to its first position. The control unit 17 receives information about the analysis results from the analysing device 14 concerning the content of particular substances and/or bacterium in the milk. The control unit 17 stores the received information about the quality of the milk from the cow 3. The milk may be stored in the collecting container 4 until the control unit 17 has received information about the quality of the milk from the analysing device 14. If the milk from the cow 3 does not perform determined requirements of the quality, the milk in the container 4 may be removed as no usable.

20 If the conduit 13 is much shorter than the first part 8a of the conduit loop 8, it is possible to only rinse the first part 8a of the conduit loop 8 with the milk from the animal to be tested. However, in the most cases it is suitable to rinse the whole passage from the milk line 1 to the collecting member 15.

30 Fig 3 shows an alternative embodiment of the device. In this case a pump 19 is comprised in the analysing device 14. When the three-way valve 12 here is in the first position, the gravitation and the pressure difference between the first end 9 and the second end 10 of the conduit loop 8 are arranged to provide a continuous milk flow in the conduit loop 8 as soon as milk flows in the milk line 1 at the first end 9 of the conduit loop 8. Thereby, an effective rinsing of the first part 8a of the conduit loop 8 is achieved. When a sample of the milk from the cow 3 has to be taken, the control unit 17 initiates an adjustment of the

three-way valve 12 from the first position to the second position. The milk in the first part 8a of the conduit loop 8 is now sucked into the second conduit 13 by the pump 19. The initial milk flow in the second conduit 13 is transported through the analysing device and out through the outlet conduit 18. The outlet conduit 18 may transport this milk back to the conduit loop 8 downstream of the three-way valve 12 or to a specific collecting container. Thereby, the initial milk flow removes possible milk residues from a previously tested cow in the passage through the second conduit 13. The final milk flow through the second conduit 13 is guided to the collecting member 15. Such a guiding of the milk to the outlet conduit 18 or the collecting member 15 may, for example, be performed by a suitable valve member, which is not shown in the figures.

By information about the flow rate in the milk line 1, the control unit 17 may keep the three-way valve 12 in the second position at a time period such that a desired amount of milk for rinsing and for sampling is delivered through the second conduit 13. The three-way valve 12 is then switched back to its first position. The control unit 17 receives information about the analysis results from the analysing device 14 concerning the content of particular substances and/or bacterium in the milk. The control unit 17 stores the received information about the quality of the milk from the cow 3. The milk may be stored in the collecting container 4 until the control unit 17 has received information about the quality of the milk from the analysing device 14. If the milk from the cow 3 does not perform determined requirements of the quality, the milk in the container 4 may be removed as no usable.

The invention is not restricted to the described embodiments of the invention but may be varied freely within the scope of the claims. The invention is not restricted to the use of a conduit loop 8 as described above. A substantially arbitrary shaped conduit having a passage between the milk line and the

collecting member may be used. It is also possible to connect the device to a milk line, which transports milk from one teat of the animal. In this case, it is, for example, possible to detect an inflammation in a specific teat of an animal.

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Claims

1. A device for sampling of milk from an animal the milk of which is to be tested, wherein the device comprises a collecting member (15) arranged to receive milk samples from a milk line (1), which is arranged to transport milk from one animal (3) at a time and a passage arranged to allow a milk flow from the milk line (1) to the collecting member (15), characterised in that the device comprises flow means (11, 19) arranged to provide a milk flow, from said animal (3), through at least a part of the passage at least a time period before a milk sample is taken in order to rinse at least said part of the passage from milk residues from a previously milked animal.
2. A device according to claim 1, characterised in that the device comprises a conduit loop (8), having a first end (9) connected to a milk line (1) and a second end (10) connected to the milk line (1) at a distance from the first end (8), and a valve member (12) arranged to allow a discharge of the milk in the conduit loop (8), wherein a first part (8a) of the conduit loop (8), which has an extension from the first end (9) to the valve member (12), comprises a first part of the passage.
3. A device according to claims 2, characterised in that the device comprises a second conduit (13) having an extension from the valve member (12) to the collecting member (15), which second conduit (13) comprises a second part of the passage.
4. A device according to claim 2 or 3, characterised in that said flow means (11, 19) is arranged to provide said milk flow in at least said part of the passage as soon as milk from said animal (3) flows in the milk line (1) at the first end (9) of the conduit loop (8).

5. A device according to any one of the preceding claims 2 to 4, characterised in that the flow means comprises a pump (11) arranged in the first part 8a of the conduit loop (8).

5 6. A device according to any one of the preceding claims 2 to 5, characterised in that the conduit loop (8) has a smaller inner cross-section area than the milk line (1).

10 7. A device according to any one of the preceding claims, characterised in that the valve member comprises a three-way valve (12).

15 8. A device according to any one of the preceding claims, characterised in that the collecting member (15) is comprised in an analysing device (14), which is arranged to analyse milk samples.

20 9. A device according to claim 8, characterised in that the flow means comprises a pump (11) arranged in the analysing device (14).

25 10. A device according to claims 2, characterised in that the device comprises a control unit (17) connected to the valve member (12) and arranged to initiate said discharge of the milk from the conduit loop (8).

30 11. A device according to claim 10, characterised in that the control unit (17) is arranged to initiate sampling of the milk only after that a certain amount of milk from said animal (3) has passed through at least said part of the passage.

35 12. A device according to any one of the claims 10 or 11, characterised in that the control unit (17) is connected to a reading device (7) and arranged to receive information from the reading device (7) about the identity of the animal (3).

13. A device according to any one of the preceding claims 10 to 12, characterised in that the control unit (17) is connected to a flow meter (16) and arranged to receive information from the flow meter (16) about the presence of a milk flow in the milk line (1).

14. A device according to any one of the preceding claims 10 to 13, characterised in that the control unit (17) is connected to the analysing device (14) and arranged to receive information from the analysing device (14) about the results of the milk samples.

15. A device according to any one of the preceding claims 1 to 14, characterised in that the device is connected to a milk line (1) arranged to transport milk from one teat of an animal (3) at a time.

16. A method for sampling of milk from an animal the milk of which is to be tested, wherein a device is used comprising a collecting member (15) arranged to receive milk samples from a milk line (1), which is arranged to transport milk from one animal (3) at a time, and a passage arranged to allow a milk flow from the milk line (1) to the collecting member (15), characterised by the step of:

providing a milk flow from said animal through at least a part of the passage at least a time period before a milk sample is taken in order to rinse at least said part of the passage from milk residues from a previously milked animal.

17. Use of a device according to any one of the claims 1-15 in an arrangement for milking of animals.

Abstract

The invention relates to a device and a method for sampling of milk. The device comprises a collecting member (15) arranged to receive milk samples from a milk line (1), which is arranged to transport milk from one animal (3) at a time, and a passage arranged to allow a milk flow from the milk line (1) to the collecting member (15). The device comprises flow means (11, 19) arranged to provide a milk flow, from said animal (3), through at least a part of the passage at least a time period before a milk sample is taken in order to rinse at least said part of the passage from milk residues from a previously milked animal.

15 (Fig. 2)

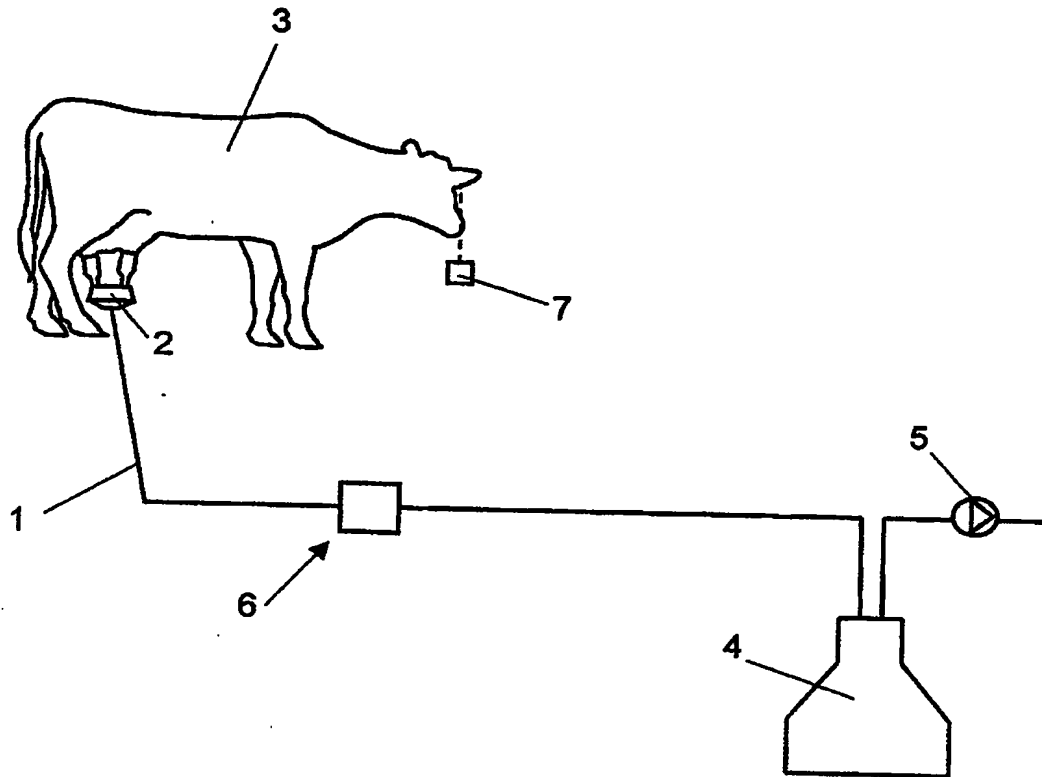


Fig 1

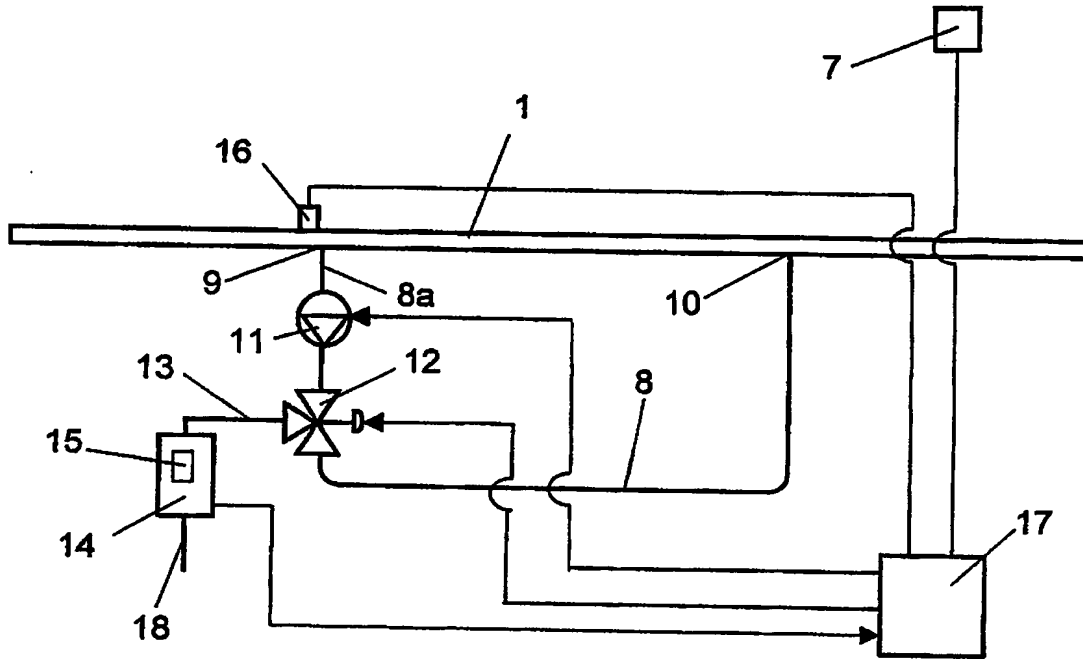


Fig 2

